

## IN THE CLAIMS

1. (Currently amended) A method for scheduling arriving data packets for input to a switch having a plurality of input ~~channels;~~ channels and a plurality of output channels, ~~said scheduling being performed in successive scheduling phases where each scheduling phase further comprises at least log N scheduling iterations;~~ the method comprising the steps of:

~~prior to a first scheduling iteration of each scheduling phase:~~

receiving at ~~each~~ one or more of said plurality of input ~~channels~~ channels, one or more data packets destined for transmission to one of said plurality of output channels and wherein each of said plurality of input and output channels are classified as unmatched prior to ~~said~~ a first scheduling iteration; and

storing said one or more received data packets into at least one data scheduling envelope associated with each of said ~~plurality of~~ one or more input ~~channels~~ channels, ~~said at least one data scheduling envelope being configured to store a plurality of data packets;~~

~~in each of said at least log N scheduling iterations of said each scheduling phase:~~

(a) assigning a channel pair weight to unmatched input-unmatched output channel pairs having a at least one data scheduling envelope storing ~~at least one~~ one or more data packets, ~~packet destined for transmission wherein the channel pair weight is computed such that it depends on a delay value of a first received data packet in the associated at least one data scheduling envelope;~~

(b) sending a match request from each unmatched input channel to an unmatched output channel having a highest channel pair weight ~~there-between~~ therebetween; and

(c) accepting a match request at each unmatched output channel from an unmatched input channel whose assigned channel pair weight ~~there-between~~ therebetween is determined to be highest from among all received match requests.

2. (Currently amended) The method of claim 1 wherein the step of assigning a channel pair weight to unmatched input-unmatched output channel pairs further includes the steps of:

for each unmatched input-output channel pair:

determining a number of bytes to be transmitted ~~there-between~~ therebetween;

determining a delay value associated with a received data packet having a highest

time-stamp to be transmitted ~~there-between~~ therebetween; and

computing an assigned channel pair weight as a linear combination of said determined number of bytes and said determined delay.

3. (Currently amended) A method for scheduling arriving data packets for input to a switch having a plurality of input channels,  $i=1...N$ , and a plurality of output channels,  $j=1...N$ , ~~said scheduling being performed in successive scheduling phases where each scheduling phase further comprises at least  $\log N$  scheduling iterations~~, each of said plurality of input channels being further comprised of  $N$  virtual output queues, VOQs  $(i,j)$ , for buffering at least one data packet  $P(i,j)$  received on the  ~~$i$ th~~  $i$ th input channel destined for the  ~~$j$ th~~  $j$ th output channel, the method comprising the steps of:

~~in each scheduling phase:~~

receiving said at least one data packet,  $P(i,j)$ , received at said  ~~$i$ th~~  $i$ th input channel destined for said  $j$ th output channel;

storing said at least one received data packet,  $P(i,j)$ , in an  $i$ th channel data scheduling envelope associated with a virtual output queue VOQ $(i,j)$ , wherein a first scheduling envelope at said VOQ $(i,j)$  is a head-of-line data scheduling envelope and a first stored data packet in said head-of-line data scheduling envelope is a head-of-line packet;

~~in each of said at least  $\log N$  scheduling iterations of each scheduling phase:~~

(a) assigning a weight,  $w_{ij}$ , to each non-empty head-of-line scheduling envelope for each unmatched input channel ~~unmatched in a previous  $\log N$  scheduling iteration~~ wherein the weight is computed such that it depends on a delay value of a head-of-line packet;

(b) sending a match request from each unmatched input channel to an unmatched output channel whose assigned weight  $w_{ij}$  ~~there-between~~ therebetween is highest;

(c) determining at each of said unmatched output channels a highest assigned weight  $w_{ij}$  from among all received input channel match requests; and

(d) granting at each of said unmatched output channels a match request to an input channel whose determined assigned weight  $w_{ij}$  ~~there-between~~ therebetween is highest.

4. (Currently amended) The method of claim 3 wherein the step of assigning a weight to each

non-empty virtual output queue VOQ(i,j) for each unmatched ~~ith~~ input channel ~~not matched in a previous scheduling iteration~~ further comprises the step of computing said assigned weight as:

$$w_{ij} = [\log_2(q_{ij}) + 1] - K$$

where  $q_{ij}$  is the number of bytes arriving at an input channel from among said plurality of input channels destined for output channel from among said plurality of output ~~channels~~, channels, and K is the logarithm of the number of bytes in a smallest received packet.

5. (Currently amended) The method of claim 3 wherein the step of assigning a weight to each non-empty virtual output queue VOQ(i,j) for each unmatched ~~ith~~ ith input channel ~~not matched in a previous scheduling iteration~~ further comprises the steps of:

determining a delay  $d_{ij}$  as a number of said at least log N scheduling iterations which have passed, as measured from a point at which a head-of-line (HOL) data packet is received in a HOL envelope at said non-empty virtual output queue VOQ(i,j);

assigning a maximum weight  $w_{ij}(\text{max})$  to said virtual output queue VOQ(i,j) if said delay  $d_{ij}$  exceeds a predetermined threshold; and

otherwise computing said assigned weight as:

$$w_{ij} = [\log_2(q_{ij}) + 1] - K$$

where  $q_{ij}$  is the number of bytes arriving at input channel destined for output channel, and K is the logarithm of the number of bytes in a smallest received packet.

6. (Currently amended) The method of claim 3 wherein the step of assigning a weight to each non-empty virtual output queue VOQ(i,j) for each unmatched ~~ith~~ ith input channel ~~not matched in a previous scheduling iteration~~ further comprises the step of computing said assigned weight as:

$$w_{ij} = [\log_2(d_{ij})] + K'$$

where  $d_{ij}$  is the delay of a head-of-line (HOL) data packet in a HOL envelope at VOQ(i,j), and  $K' = [\log_2[E]] - K$

where

E is the number of bytes per envelope, and

K is the logarithm of the number of bytes in a smallest received packet.

7. (Currently amended) The method of claim 3 wherein the step of assigning a weight to each non-empty virtual output queue VOQ(i,j) for each ~~unmatched~~ lth ith input channel ~~not matched in a previous scheduling iteration~~ further comprises the step of computing said assigned weight as:

$$w_{ij} = [\log_2(d_{ij})] + [\log_2(e_{ij}) - K]$$

where

$e_{ij}$  is the number of bytes in a head-of-line (HOL) envelope;

$d_{ij}$  is the delay of a HOL data packet in a HOL envelope at VOQ(i,j); and

K is the logarithm of the number of bytes in a smallest received packet.

8. (Currently amended) Apparatus for scheduling arriving data packets for input to a switch having a plurality of input channels and output channels, each of said plurality of input channels being further comprised of J virtual output queues, VOQs (i,j), for buffering said data packets received on the ~~lth~~ ith input channel destined for the jth output channel, DP(i,j), the apparatus comprising:

means, associated with each input channel, for storing the data packets, DP(i,j), arriving at the associated input channel in at least one scheduling envelope residing at an associated VOQ(i,j);

means, associated with each input channel, for assigning a weight,  $W_{ij}$ , to each VOQ(i,j) having at least one non-empty scheduling envelope wherein the weight is computed such that it depends on a delay value of a first received data packet in the associated at least one data scheduling envelope;

means, associated with each input channel, having at least one VOQ(i,j) having an assigned weight,  $W_{ij}$ , for sending a request to the jth output having the highest assigned weight  $W_{ij}$ ; and

means, associated with each output channel J, for granting a request from an output channel J, responsive to said received input channel requests, to an input channel I having the highest assigned weight,  $W_{ij}$ .

9. (Original) The apparatus of claim 8, further including:

means, associated with each output channel, for matching an input-output channel pair wherein the input-output channel pair has the highest assigned weight,  $W_{ij}$ , therebetween.

10. (Original) The apparatus of claim 8, wherein the means for assigning a weight to each VOQ(i,j) further includes,

means, associated with each VOQ(i,j), for determining a total number of bytes comprising said stored data packets arriving at the associated VOQ(i,j); and

means, associated with each VOQ(i,j), for determining a delay associated with a head-of-line packet.

11. (Currently amended) A switching apparatus for distributing data packets input from each of a plurality of input ports to a plurality of output ports, said switching apparatus comprising:

a comparator connected to simultaneously receive weight elements in successive clock cycle iterations, wherein the weight elements are computed such that they depend on a delay value of a first received data packet, said comparator configured to output a largest weight element from among the received weight elements in each clock cycle iteration;

a demultiplexer configured to receive said largest weight element from said comparator, said demultiplexer further configured to distribute said largest weight elements to output lines; and

a plurality of comparators each configured to receive the largest weight elements from a corresponding output line of said output lines, each of said plurality of output comparators being further configured to output a largest weight element from among said received weight elements.

12. (Currently amended) A switching apparatus for distributing data packets input from each of a plurality of input ports to a plurality of output ports, said switching apparatus comprising:

means for simultaneously receiving weight elements in successive clock cycle iterations wherein the weight elements are computed such that they depends on a delay value of a first received data packet;

means for outputting a largest weight element from among the received weight elements in each clock cycle iteration;

means for distributing said largest weight element from said outputting means; and

output selection means for selecting the overall largest weight element from among a plurality of largest weight elements received from said distributing means.

13. (New) The method of claim 1, wherein the steps of assigning a channel pair weight, sending a match request, and accepting a match request are performed in successive scheduling phases.

14. (New) The method of claim 13, wherein each scheduling phase comprises at least  $\log N$  scheduling iterations.

15. (New) The method of claim 3, wherein the steps of assigning a weight, sending a match request, determining a highest assigned weight, and granting a match request are performed in successive scheduling phases.

16. (New) The method of claim 15, wherein each scheduling phase comprises at least  $\log N$  scheduling iterations.